REVISION OF PERMIAN PLEUROTOMARIAN GASTROPODS FROM THE CARNARVON AND BONAPARTE BASINS, WESTERN AUSTRALIA

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The revision of pleurotomarian gastropod species from Western Australia has seen the generic reassignment of three species and description of four new species in three genera, *Mourlonia*, *Ptychomphalina* and *Glabrocingulum*. Three species of the genus *Glabrocingulum* are recorded from Western Australia for the first time.

IN A SERIES of investigations Dickins (1956, 1957, 1961, 1963) has studied and described many bivalve and gastropod species from the Western Australian Permian marine sequences. These have been reviewed by Dickins & Skwarko (1993) but many additional collections remain to be described.

Early descriptions of gastropods including those of Etheridge Jnr (1897, 1907) and Hosking (1931) were only isolated specimens. Since Dickins (1963) no major work on Western Australian Permian gastropods has been published. In his work on the geology of the Carnarvon Basin, Condon (1967) provides faunal lists as part of his description of each stratigraphic unit, but the bivalves and gastropods are compiled largely from the work of Dickins (1963).

Subsequent taxonomic and systematic palaeontological studies by authors such as Batten (1967, 1972), Playford et al. (1975, 1976) and Taboada (1997) have resulted in the review some of Dickins' 1963 work. This paper examines previously undescribed collection material housed in the Australian Geological Survey Organisation (formerly Bureau of Mineral Resources) collections.

Species described are from the marine sequence of the Carnarvon Basin, and the Bonaparte Gulf Basin. The most recent review of the stratigraphy of the Carnarvon Basin is found in Hocking et al. (1987), whilst Dickins et al. (1972) provide information about the onshore Bonaparte Gulf Basin.

SYSTEMATIC PALAEONTOLOGY

Phylum MOLLUSCA

Class GASTROPODA

Superfamily PLEUROTOMARIACEA Swainson, 1840

Family EOTOMARIIDAE Wenz, 1938

Tribe PTYCHOMPHALIDES Wenz, 1938.

Dickins (1963) argued that Permian pleurotomarians should be placed within the family Pleurotomariidae because their overall characteristics are more similar to those of the Pleurotomariidae than to those of the Eotomariidae. Batten (1967) subsequently concluded that although Permian pleurotomarians do not closely resemble the genus *Eotomaria* they do have many characteristics in common with other younger members of the family. Batten noted that *Eotomaria*, an Early Palaeozoic gastropod, is not typical of members of the family, many of which are more specialised. The Pleurotomariidae, however, are a group of Mesozoic and Tertiary forms and in the interests of consistency the Permian Pleurotomarians are retained within the Palaeozoic family Eotomariidae.

Genus Mourlonia de Koninck 1883

Type species. *Helix carinatus* Sowerby, 1812. From the Lower Carboniferous, Visean, near Settle, Yorkshire, England.

Thomas (1940) considered that *Ptychomphalina* should be regarded as a synonym of *Mourlonia*. Knight et al. (1960) regarded *Ptychomphalina striata* (J. Sowerby) 1817 to be a synonym of *Mourlonia carinata* (J. Sowerby) 1812, and therefore considered *Ptychomphalina* a synonym of *Mourlonia*. Batten (1967) considered that the two species probably represented two distinct groups within the species. Dickins (1978) argued that there were sufficient differences between the species to warrant their individual status and furthermore, that if *Ptychomphalina* were to be regarded as a synonym of *Mourlonia* then there would be a number of species left without a generic name.

Dickins (1978) noted that the selenizone of *Ptychomphalina* was distinctively different from that of *Mourlonia*, it being flat in *Mourlonia* and *Ptychomphalina* having a distinct groove under the selenizone. He also notes that transverse ornament is more strongly developed in the type species of *Ptychomphalina*, whereas it is subdued in *Mourlonia*. Knight (1952) was the first to recognise the importance of the slit in terms of gastropod morphology and therefore its importance in gastropod classification, a view supported by Yochelson (1984). Gordon & Yochelson (1987) defined the major difference between *Ptychomphalina* and *Mourlonia* as a difference in the appearance and structure of the selenizone, with *Ptychomphalina* having a distinctly raised selenizone. *Mourlonia* possesses a flat to convex selenizone whilst *Ptychomphalina* possesses a raised concave selenizone bordered by distinctive ridges. This view is supported by Taboada (1997) who assigned members of two species previously thought to be *Mourlonia* to *Ptychomphalina* on this basis.

Mourlonia maitlandi (Etheridge Jnr, 1903)

Fig. 1A–C, E

Ptychomphalina maitlandi Etheridge Jnr, 1903: p. 24, pl. 1, figs 13–15.
Ptychomphalina maitlandi—Dickins, 1963: 126, pl. 24, figs 9–11.
Ptychomphalina maitlandi—Dickins, 1963: 126, pl. 24, figs 9-11; pl. 57, fig. 4.
?*Ptychomphalina maitlandi* Etheridge, 1914: 37.
?*Ptychomphalina maitlandi*—Hosking, 1931: 36.
?*Ptychomphalina maitlandi*—Raggatt & Fletcher, 1937: 178.
?*Ptychomphalina maitlandi*—Dickins & Thomas, 1956: 51.
?*Ptychomphalina maitlandi*—Guppy et al. 1958: 49.
?*Ptychomphalina maitlandi*—Condon, 1967: 169.
?*Ptychomphalina* cf. *maitlandi*—Condon, 1967: 169.
?*Ptychomphalina maitlandi*—Playford et al. 1975: 287.
?*Ptychomphalina maitlandi*—Playford et al. 1976: 117.

This species is reassigned to *Mourlonia* on the basis of shape of selenizone and overall morphology, flat selenizone characteristic of *Mourlonia*.

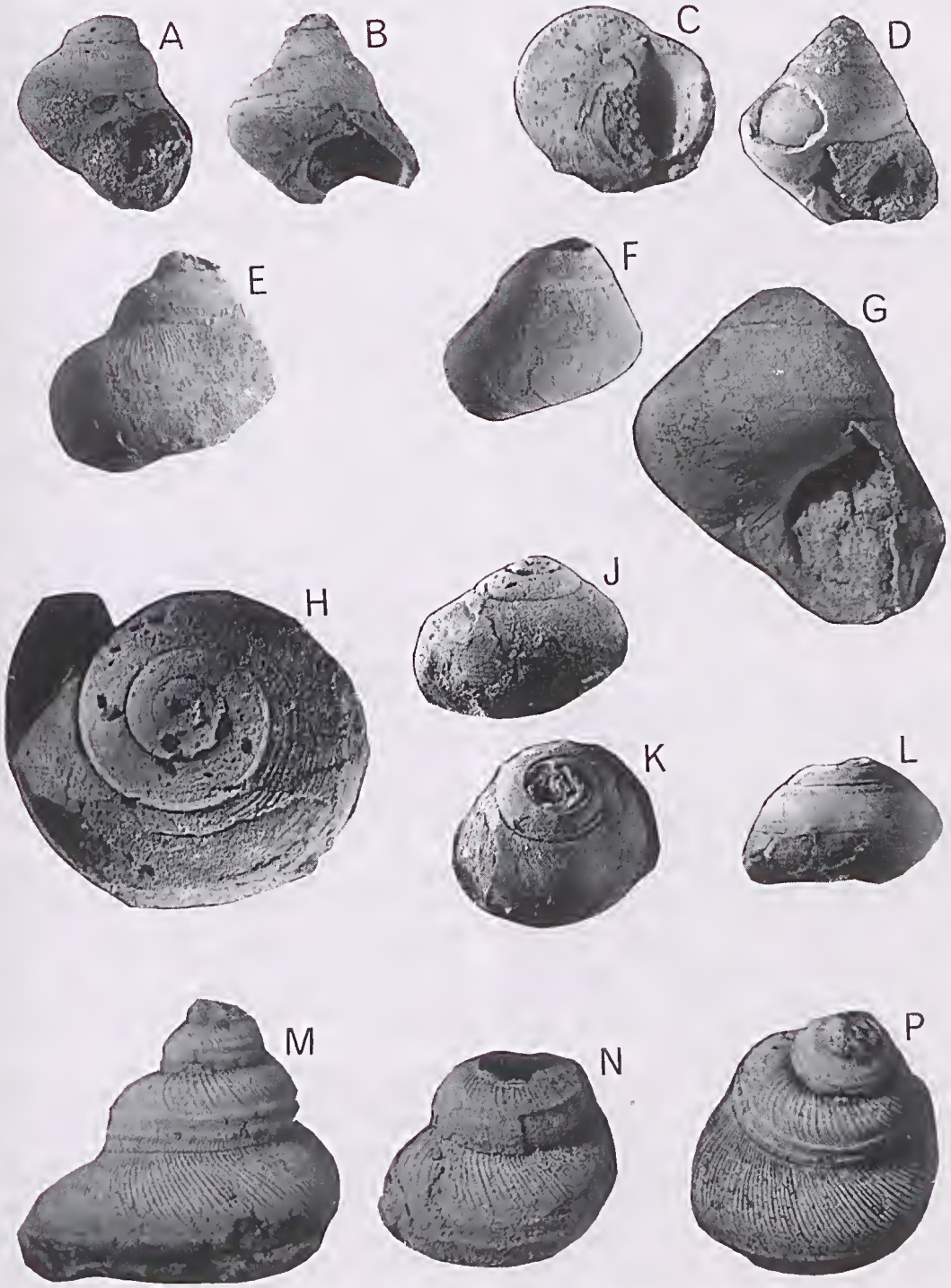
Material and localities. One specimen from AGSO locality G353 (CPC 34939), precise location unknown, top of Mallens Sandstone. One specimen from locality ML9 (CPC 34938), 75 m above base of section, SE of Donnelly's Well, Coyrie Formation. One specimen from AGSO locality F17 104, 2.4 km S of Merlinleigh Homestead, 90 m N of Merlinleigh–Mount Sandiman Road, Bulgadoo Shale. One specimen from the Nalbia Sandstone, precise locality unknown. One specimen from AGSO locality ML125, W of Big Hill, SW of Muderong Bore, lat. 24°07′41″, long. 114°46′00″. Coolkilya Formation.

Diagnosis. Shell small for genus, profile stepped. Flat selenizone bordered by lirae. Growth lines well defined.

Description. Upper part of whorl slightly concave immediately below selenizone, then convex profile resulting in gentle stepped appearance of shell. Lower whorl surface convex. Selenizone flat, decorated with fine lunulae at periphery of whorl and bordered by lirae, just above whorl suture. Surface ornamentation of well defined growth lines, faint trace of one or two spiral lirae on upper part of whorl surface. Aperture round, no umbilicus.

Discussion. This species is herein referred to *Mourlonia* on the basis of selenizone structure and overall appearance—the flat selenizone being characteristic of *Mourlonia*, and *Ptychomphalina* possessing a raised selenizone with concave profile and distinct ridged borders, as discussed in this paper. This species is similar to *M. talboti* (Dickins 1963) from the Late Sakmarian Fossil Cliff Formation, Perth Basin, but is easily distinguished by its curved whorl profile and more prominent growth lines. This species has not previously been recorded in the Carnarvon Basin and this record also extends its range from the Late Sakmarian to the Kungurian.

Fig. 1. A, *Mourlonia maitlandi* (Etheridge Jnr, 1903), apertural view, CPC 34938, ×2. B, *Mourlonia maitlandi* (Etheridge Jnr, 1903), apertural view, CPC 34939, ×2. C, *Mourlonia maitlandi* (Dickins, 1963), basal view, CPC 34939, ×2. D, *Mourlonia talboti* (Dickins, 1963), apertural view UWA 8485, ×2. E, *Mourlonia maitlandi* (Etheridge Jnr, 1903), side view showing ornament, CPC 34938, ×3. F, G, *Mourlonia talboti* (Dickins, 1963), side view, apertural view CPC 34940, ×1.5, ×4. H, J, *Mourlonia demissus* sp. nov., holotype, apical view, side view SAM P2194A, ×2.5, ×1. K, L, *Mourlonia demissus* sp. nov., tilted apical view, side view SAM P2194B, ×1. M, P, *Ptychomphalina dickinsi* sp. nov., holotype, side view, tilted side view, CPC 34941, ×4. N, *Ptychomphalina dickinsi* sp. nov., tilted side view, CPC 34942, ×4.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Stratigraphy and age. Bulgadoo Shale, Nalbia Sandstone, Coyrie Formation. Artinskian–Baigendzhinian to Kungurian in age.

Mourlonia talboti (Dickins, 1963)

Fig. 1D, F–G

Ptychomphalina talboti Dickins, 1963: 125, pl. 24, figs 12–19.
Mourlonia talboti Batten 1972: 15, fig. 9.
Ptychomphalina talboti Playford et al. 1976: 96.
Mourlonia talboti Batten, 1985. 38.
Mourlonia talboti Hollingworth & Barker 1991: 354.
Ptychomphalina talboti Dickins & Skwarko, 1993: microfiche supplement p. 19, pl. 57, figs 8, 12, 13.

Holotype. CPC 4007, Fossil Cliff, Fossil Cliff Formation.

Material and localities. One specimen from AGSO locality GW54, 7.6 km bearing 115° from Dairy Creek Homestead, on south branch of Bush Creek, Coyrie Formation, Carnarvon Basin. One specimen from AGSO locality WB75, 2.2 km on a bearing of 176° from Bogadi Outcamp, Upper Madeline Formation. One specimen from AGSO locality ML9. One specimen (CPC 34940) from AGSO locality F23985 (also AGSO locality WB81), 3.8 km on a bearing 046° from Keogh Hill, Upper Madeline Formation. One further specimen from the Coolkilya Formation, precise locality unknown. Also examined 6 specimens, all numbered 8485 from the UWA collection.

Diagnosis. Small for genus. Shell conical, whorl surfaces flat, slight step at selenizone. Flat selenizone at periphery of whorl, adjacent to suture.

Description. The upper whorl surface is flat, whilst the lower surface is moderately convex. The suture is situated immediately below the selenizone and the shell is conical. The selenizone is flat in appearance, bordered on either side by very fine lirae, and shows faint ornamentation of lunulae. Growth lines are visible, generally prosocline except immediately below selenizone where they are opisthocline for a short distance. Overall shell appearance is smooth. The shell has a rounded aperture, no umbilicus and callus extends only a short distance outside the aperture.

Discussion. This species is herein referred to *Mourlonia* on the basis of its selenizone structure and overall appearance. It is similar to *M. maitlandi* (Etheridge, 1903) from Wandagee Station, Minilya River, Western Australia, but distinguished primarily on the basis of whorl profile, *M. talboti* possessing a flat upper whorl profile and *M. maitlandi* a curved one. The material assigned to *M. talboti* by Batten (1972) from the H. S. Lee Mine, Perak, Malaysia, of Late Artinskian age, is different in appearance, being much more curved, and possessing a well defined raised selenizone. Without examination of the material this specimen appears more closely allied to *P. dickinsi* sp. nov. than *M. talboti*.

Stratigraphy and age. Coyrie Formation, Upper Madeline Formation, Coolkilya Formation, Late Artinskian–Baigendzhinian to Kungurian.

Mourlonia demissus sp. nov.

Fig. 1H–L

?*Mourlonia humilis*—Etheridge 1889, p. 205.
Mourlonia humilis—Etheridge 1897, p. 15, pl. 1, fig. 11.
Ptychomphalina humilis—Etheridge, 1907.
Mourlonia humilis—Maitland, 1919, p. 30.
non *Pleurotomaria humilis* de Koninck, 1877, p. 187, pl. 23, fig. 14.
non *Mourlonia humilis*—Fletcher 1958, p. 118.

This species was originally described from a single specimen found at Raymond Terrace, New South Wales. Specimens from Western Australia were assigned to this species by Etheridge in 1889, 1897 and 1907. The type specimen was destroyed by fire in 1882 (Fletcher 1958), prior to Etheridge assigning any material from Western Australia or the Northern Territory to this species. Fletcher (1958) considers it extremely unlikely that the specimen described by de Koninck is the same as those described by Etheridge. Of the material described and in some cases figured by Etheridge only two specimens have so far been located, these being two of the three specimens figured in Etheridge's 1907 paper. These are herein described as a new species.

In view of the destruction of de Koninck's type specimen of *P. humilis* and the lack of material readily identifiable with his species, it is suggested herein that the name *P. humilis* be allowed to lapse in the interest of nomenclatural stability.

Etymology. From the Latin for low, reflecting the name originally attributed to these specimens reflecting low whorl height.

Holotype. SAM P2194A, natural cast of shell from Fossil Head, Port Keats District, Bonaparte Basin, Northern Territory.

Material and locality. SAM P2194A–B, two incomplete specimens, one (holotype) of approximately 4 whorls, one of two whorls, Fossil Head, Northern Territory.

Diagnosis. Low spired turbiniform shells, spiral and collabral ornament present, slightly raised flat selenizone at whorl suture.

Description. Low spired turbiniform shells, spiral and collabral ornament present but worn. Numerous spiral lirae above and below selenizone. Whorl profile flat to slightly convex on upper whorls, turbiniform later whorls. Selenizone at whorl suture forming slight stepped appearance. Growth lines strongly prosocline above selenizone, opisthocline immediately below selenizone then more gently prosocline. Nature of aperture not known. Umbilicus obscured in both specimens.

Discussion. *Mourlonia demissus* is markedly different to any other *Mourlonia* found in Western Australia. The overall shell shape is most like that of *M. talboti* (Dickins, 1963) from Fossil Cliff, Irwin River area, Western Australia, but is readily differentiated by its broader, lower spired shape. Both *M. demissus* and *M. talboti* are distinctive in having a smooth profile without change in angle near the suture.

Stratigraphy and age. Beds at Fossil Head, Treachery Bay, Port Keats area, Kungurian.

Genus **Ptychomphalina** (Fischer, 1887)

Type species. *Helix? striatus* Sowerby 1817.

The status of the genus *Ptychomphalina* has raised considerable discussion. Its relationship with the genus *Mourlonia* has recieved considerable attention and is discussed earlier in this paper.

Ptychomphalina dickinsi sp. nov.

Fig. 1M–P

Etymology. In recognition of the work of J. M. Dickins on the Permian gastropods of Western Australia.

Materials and locality. Holotype: CPC 34941, incomplete mould from AGSO locality GW54, 7.6 km bearing 115° from Dairy Creek Homestead, on south branch of Bush Creek, Carnarvon Basin. One further specimen (CPC 34942) from same locality.

Diagnosis. Well defined selenizone bordered by prominent ridges with concave centre, positioned above suture. Rounded whorls, stepped profile.

Description. Moderately high spired shell, distinctive stepped profile with rounded whorls. Selenizone above suture, bordered by pronounced lirae, concave in shape and bearing numerous fine lunulae. Strong prosocline collabral ornament on upper whorl surface, fine below selenizone

Discussion. *Ptychomphalina dickinsi* bears some resemblance to the specimen described and figured as *Mourlonia talboti* by Batten (1972), which shows similar ornament and profile and appears to possess the same distinctive concave selenizone which would place it in the genus *Ptychomphalina* rather than in *Mourlonia*. It is similar in appearance to *Ptychomphalina australis* (Sabattini & Noirat, 1969) as redescribed by Taboada (1997) from the Booral Formation, New South Wales, Australia, but has a more distinctively stepped profile and relatively narrower selenizone. Taboada (1997) describes two new species of *Ptychomphalina* (*P. turgentis* and *P. sabattinii*) from the La Capilla Formation, Corral Villa, 5 km north of Calingasta, San Juan Province, Argentina, which have similar ornamentation but both are lower spired than *P. dickinsi*. *P. dickinsi* is most similar to *P. kuttungensis* (Campbell 1961) from the Isaacs Formation, New South Wales, which is also rounded but shows a less stepped profile.

Stratigrapy and age. Coyrie Formation, Carnarvon Basin. Artinskian, Baigendzhinian.

Tribe EOTOMARIIDES Wenz, 1938

Genus **Glabrocingulum** Thomas, 1940

Type species. *Glabrocingulum beggi* Thomas, 1940. From the Hollybush limestone, Caleiferous sandstone series, Visean, Scotland.

The genus *Glabrocingulum* was erected by Thomas (1940) to describe species from the Carboniferous in Scotland. Subsequent revision of the genus by Sloan (1955) broadened the definition to include a number of similar genera which he designated subgenera within a broader scale grouping. Sloan describes the genus as best characterised by its ornamentation. Revolving and transverse ornamentation are both present with nodes marking the intersection of the systems of lines. The selenizone lies on the angle between the upper and lower whorl surfaces. In Permian species the selenizone is very much narrower than in earlier forms (Batten 1972).

Subgenus **Glabrocingulum (Stenozone)** Batten, 1972

Type species. *Glabrocingulum (Stenozone) nodosuturala* Batten, 1972. From the H. S. Lee Mine No. 8 near Kampar, Perak, Malaysia.

This subgenus was erected by Batten (1972) for a group of *Glabrocingulum* species which are unusually large for the genus. Importantly they have dominant spiral ornament, collabral ornament is limited largely to interference nodes, giving the appearance of rows of nodules. These tend to be most prominent closest to the suture. In this subgenus the alveozone (as defined by Batten 1972) or trough just below the selenizone is missing, giving a more uniform appearance. Species tend to be turbiniform to trochiform in shape. The subgenus refers to a group of species known from the Permian of Asia and South America.

Diagnosis. The diagnosis provided by Batten (1972) is accepted.

Discussion. Waterhouse (1963) notes that *Platyteichum johnstonei* bears closest resemblance to *Pleurotomaria timorensis* (Wanner, 1922) from the Basleo Beds of Timor, both of which were subsequently assigned to *Glabrocingulum (Stenozone)* by Batten (1972). *Platyteichum* and *Mourlonia* are differentiated on the basis of whorl profile—*Platyteichum* has a flat upper whorl while *Mourlonia* has a gently convex upper whorl. The major characteristic distinguishing *Glabrocingulum* and *Platyteichum* is that the selenizone and coiling suture are perpendicular to the columella in *Glabrocingulum* but at an angle less than perpendicular in *Platyteichum*. *Platyteichum johnstonei* has dominant spiral ornamentation, step like whorl profile and the selenizone/coiling suture is perpendicular to the columella. On the basis of these features it is transferred to this genus.

Glabrocingulum (Stenozone) johnstonei (Dickins 1961)

Fig. 2A–D

Platyteichum johnstonei Dickins 1961, p. 134, pl. 17, figs 9–12.
Platyteichum johnstonei Waterhouse 1963, p. 130.
Glabrocingulum (Stenozone) johnstonei Batten, 1972, p. 18.
Platyteichum johnstonei Dickins & Skwarko, 1993: microfiche supplement p. 20, pl. 57, figs 15–16.

Material and localities. Incomplete specimen (CPC 34943) from AGSO location F17 104, 1.5 miles south of Merlinleigh Homestead, 100 yds north of Merlinleigh–Mt Sandiman Road. Holotype UWA 42115, and figured specimen UWA 27371, from University of Western Australia collection.

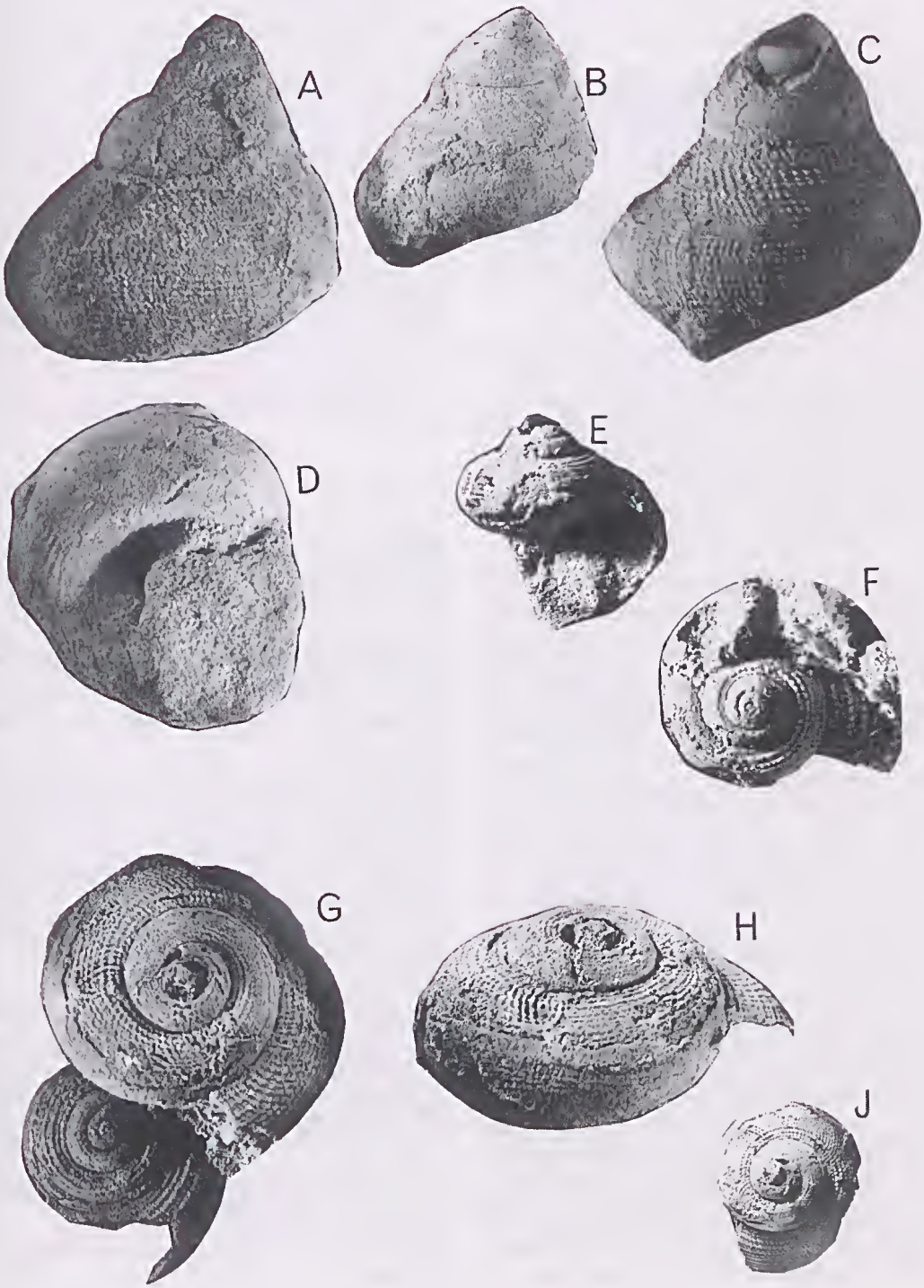
Diagnosis. Numerous spiral lirae evenly spaced, fewer above selenizone. Growth lines prosocline above selenizone, forming small nodes at intersections with lirae. Selenizone above midpoint of whorl. Phaneromphalous.

Description. Globose shell, moderately high spired, distinct shallow sutures. Selenizone just above periphery of whorl and bordered by spiral lirae very similar to the rest of the spiral ornament. Spiral ornament dominant consisting of numerous lirae of equal prominence above and below the selenizone. Faint growth lines visible prosocline above selenizone, forming nodes at intersections of spiral lirae. growth lines less clear below selenizone. Phaneromphalous.

Discussion. Batten (1972) described *G. (S.). johnstonei* as similar to *G. (S.) timorensis* (Wanner, 1922) from the Basleo Beds, Timor, and *G. (S.) brennensis* (Reed, 1932) from the Agglomeratic Slate of Kashmir, which agrees with an earlier observation by Waterhouse (1963) grouping these species on the basis of similar characteristics. Thus the species from western Australia, Timor and the Agglomeratic Slate of Kashmir show more similarities than species from eastern Australia and New Zealand. *G. (S.) johnstonei* shows most similarity to *G. (S.) brennensis* but can be differentiated by its more gently sloping whorl surface, shallower suture trough and finer growth lines and nodes.

Stratigraphy and age. Bulgadoo Shale. Baigendzhinian (Late Artinskian).

Fig. 2. A, D, *Glabrocingulum (Stenozone) johnstonei* (Dickins, 1961), side view, basal view, UWA 27371, ×2. B, *Glabrocingulum (Stenozone) johnstonei* (Dickins, 1961), side view, CPC 34943, ×1. C, *Glabrocingulum (Stenozone) johnstonei* (Dickins, 1961), holotype, side view showing ornament, UWA 42115, ×1.5. E, F, *Glabrocingulum (Stenozone) costatiformis* sp. nov., holotype, apertural view, apical view, CPC 34944, ×3. G, upper specimen *Glabrocingulum (Stenozone) elegans* sp. nov., holotype, apical view showing ornament pattern, CPC 34946, ×2; lower specimen on same slab, *Glabrocingulum (Stenozone) costatiformis* sp. nov., apical view, CPC 34945, ×2. H, *Glabrocingulum (Stenozone) elegans* sp. nov., tilted side view, CPC 34946, ×2. J, *Glabrocingulum (Stenozone) elegans* sp. nov., apical view, CPC 34946, ×1.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Glabrocingulum (Stenozone) costatiformis sp. nov.

Fig. 2E–G

Etymology. Latin for ribs.

Material and locality. Holotype: Specimen No. CPC 34944; from AGSO locality CC89, Wandagee Formation, precise location unknown. One further specimen from AGSO locality GW329 (CPC 34945), Coolkilya Formation, precise location unknown.

Diagnosis. Very low conical turbiniform shells, nodes near to suture, spiral ornament dominant, collabral ornament marked only by nodes on spiral ornament. Whorls flattened towards suture. Selenizone a flat band above suture.

Description. Turbiniform shell, very flat whorl surface flat towards suture curved towards periphery. Selenizone a flat band above suture, spiral ornament dominant, collabral ornament marked only by nodes on well spaced spiral ornament. Nodes more pronounced towards top of whorl, convex whorls flattened towards suture, some secondary spiral ornament on surface of whorl close to suture. Specimens small for genus.

Discussion. Glabrocingulum (Stenozone) costatiformis is an unusually small species. It is similar in general appearance to *G. (S.) nodosuturala* Batten (1972) from the H. S. Lee Mine, Perak, Malaysia, but has a smooth rounded whorl profile and the ribs are much more pronounced than the collabral ornament. Where the collabral ornament crosses the ribs nodes are formed but they are smaller than those of *G. (S.) nodosuturala.* The ribs are narrow, well defined and spaced well apart especially close to the suture in contrast to *G. (S.) nodosuturala.* There are about five or six ribs visible on the whorl surface above the selenizone. Ornament on the lower surface is not visible except at the broken margin but appears to be wider spaced ribs similar to *G. (S.) nodosuturala.*

This species bears close resemblance to the specimens described and figured by Waterhouse (1987) as *Platyteichum coniforme* from the Flat Top Formation, Bowen Basin, Queensland, but *G. (S.) costatiformis* has a lower spire and flatter profile. Waterhouse includes the specimens described by Dickins (1961) as *Platyteichum costatum* in his description of *P. coniforme*, but Dickins' specimen which is the holotype shows a very different, almost smooth profile rather than the stepped shell figured by Waterhouse. Furthermore both specimens show the ornamentation pattern of nodes at the intersection of spiral and collabral ornament that is considered distinctive of the genus *Glabrocingulum.* Dickins also figures the holotype of *Platyteichum coniforme* which again has a smooth shell profile rather than the stepped profile shown by the specimen of *P. coniforme* figured by Waterhouse (1987).

Mourlonia? *lyndonensis* Dickins (1957), from the upper part of the Lyons group, Carnarvon Basin, Western Australia, bears close resemblance to *G. (S.) costatiformis* but appears to have a more pronounced selenizone and narrower whorls. Examination of the specimens of *M.*? *lyndonensis* may show it to belong in this genus.

Stratigraphy and age. Wandagee Formation, Coolkilya Formation, Late Artinskian–Baigendzhinian to Kungurian.

Glabrocingulum (Stenozone) elegans sp. nov.

Fig. 2G–J

Etymology. Latin for fine, delicate.

Holotype. CPC 34946, Coolkilya Formation, Kungurian.

Material and location. Single specimen (holotype) on slab, from AGSO locality GW329, Coolkilya Formation, precise location unknown.

Diagnosis. Very narrow selenizone just below suture on whorl, spiral ornament dominant, fine collabral ornament forming nodes at intersection with spiral ornament, well rounded smooth whorl profile.

Description. Turbiniform, narrow selenizone just below suture on whorl, spiral ornament dominant, widely spaced at top of whorl, closer adjacent to selenizone and close below selenizone, narrow depression adjacent to suture, fine nodes formed at intersection of collabral and spiral ornament, nodes more prominent towards top of whorl. Growth lines prosocline above and below selenizone, more so above. Small for genus.

Discussion. This species is distinguished by the very fine nature of the ornament. The selenizone is marked by the deflection of growth lines, but is not bordered by distinctive lirae. It possesses the characteristic pattern of nodes at the intersection of the spiral and collabral ornament that are distinct to the genus, but the ornamentation is much finer than other representatives of the species and the selenizone is much less distinct.

Stratigraphy and age. Coolkilya Formation, Kungurian.

CONCLUSION

It is interesting to note that the species described in this paper are all very small representatives of their genera. It is possible that they may have been living at the edge of their generic range and thus been restricted in their growth. It may also be a reflection of environmental conditions such as temperature restricting their growth.

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